Monday, January 11, 2016 12:24 PM

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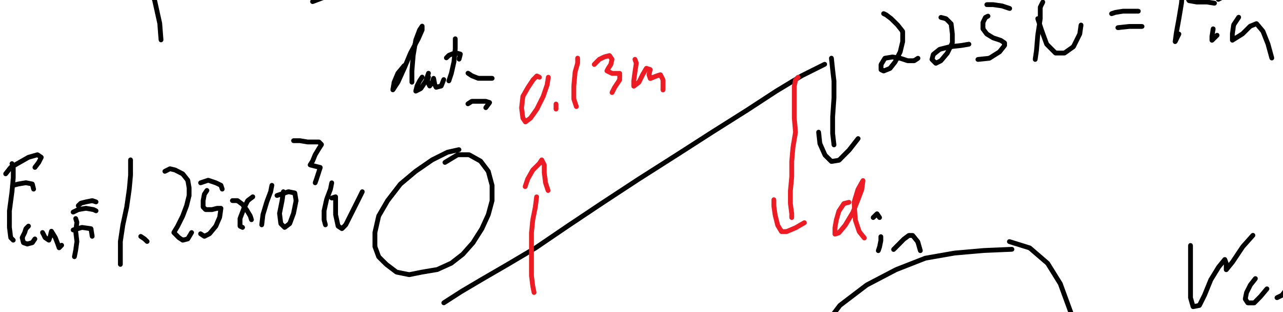
Q 15



$$eff = 88.7\% = \frac{W_{out}}{W_{in}} \times 100\%$$

$$88.7\% = \frac{F_{out}\, d_{out}}{F_{in}\, d_{in}} \times 100\%$$

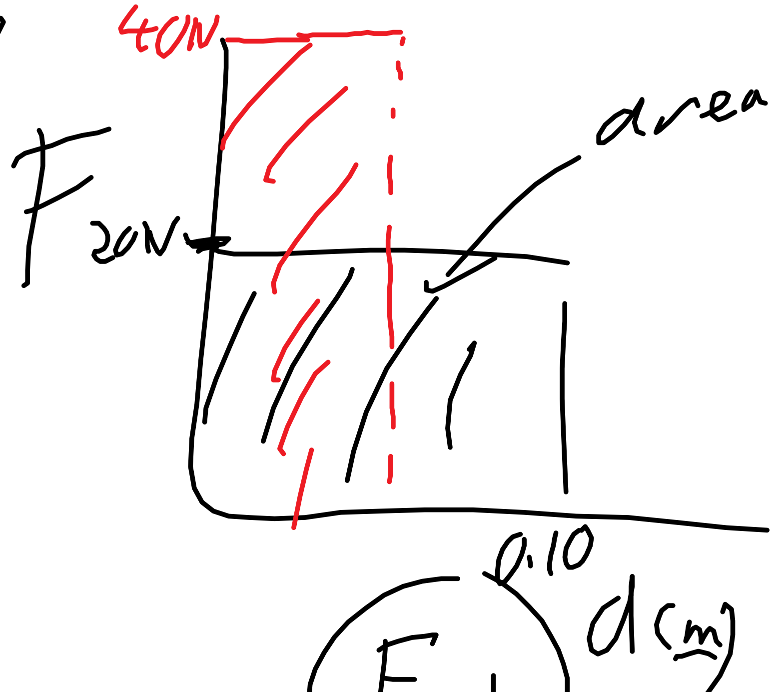
$$88.7\% = \frac{1.25 \times 10^3\,N \times 0.13\,m}{225\,N \; d_{in}} \times 100\%$$

$$225\, d_{in} \times 0.887 = 1.25 \times 10^3 \times 0.13\,m$$

$$\boxed{d_{in} = 0.81\,m}$$

2.3 40N [illegible] 20N x 0.10m

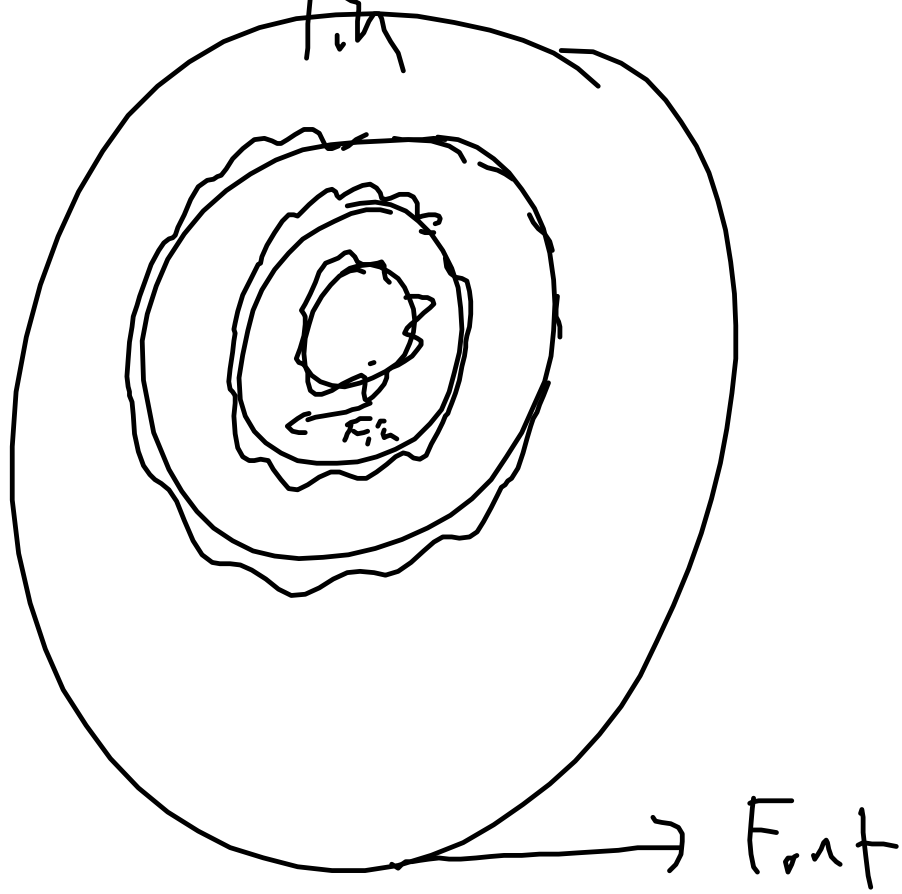
2.3



area = 20N × 0.10m
= 2.0J

$$MA = \frac{F_{out}}{F_{in}} = 2 = \frac{d_{in}}{d_{out}}$$

Q 2.4



Energy

Demonstrations:
Bowling Ball of Death:
Drop a bowling ball on a string and it swings back to the same point, no higher.

Drop vs Swing
You drop a ball from the same height as you swing a ball.
Which ball is moving faster?
Prediction: a) swing b) drop c) same d) explodes

Answer: same

What's the deal?

Gravitational energy is transformed into kinetic energy for both paths.
If no energy is lost (resistive forces) the energy of motion - kinetic energy - is the same for both objects.

Gravitational energy, E_g.
How do we quantify energy?
Use Work = change in energy = Fd

$W_g = \Delta E_g = F_g d = mgd = mg\ \Delta H$

If m and g are constant g is the gravitational field strength = 9.80 N/kg near Earth

$E_g = mgh$

Eg. You have a 500 g mass 1.5 m above the ground. What is the gravitational energy?

$E_g = mgh$

$= 0.50\ kg\ 9.80 N/kg\ 1.5 m =$

$0.5 \times 9.8 \times 1.5 = 7.35 \quad = 7.4\ J$

Kinetic Energy, E_k

Energy of motion.

Changes in motion are the result of the net force, F_{net}.

$F_{net} = ma$

$W_{net} = \Delta E_k$

$F_{net} d = \Delta E_k$

$mad = \Delta E_k$

If a is uniform, $v_f^2 = v_i^2 + 2ad$

$ad = 1/2\,(v_f^2 - v_i^2)$

$mad = \Delta E_k$

$$m\frac{1}{2}(v_f^2 - v_i^2) = \Delta E_k$$

$$\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 = \Delta E_k$$

$$E_{kf} - E_{ki}$$

$$\therefore \boxed{E_k = \frac{1}{2}mv^2}$$

e.g. A 0.10kg ball is dropped from 0.70m

a) determine E_{gi}

b) v_f if it falls straight down

c) v_f if it swings throu

a 1.2 m arc to the same bottom point.

d) If the speed at the bottom is only 2.0 m/s how much energy is lost? Where did it go?

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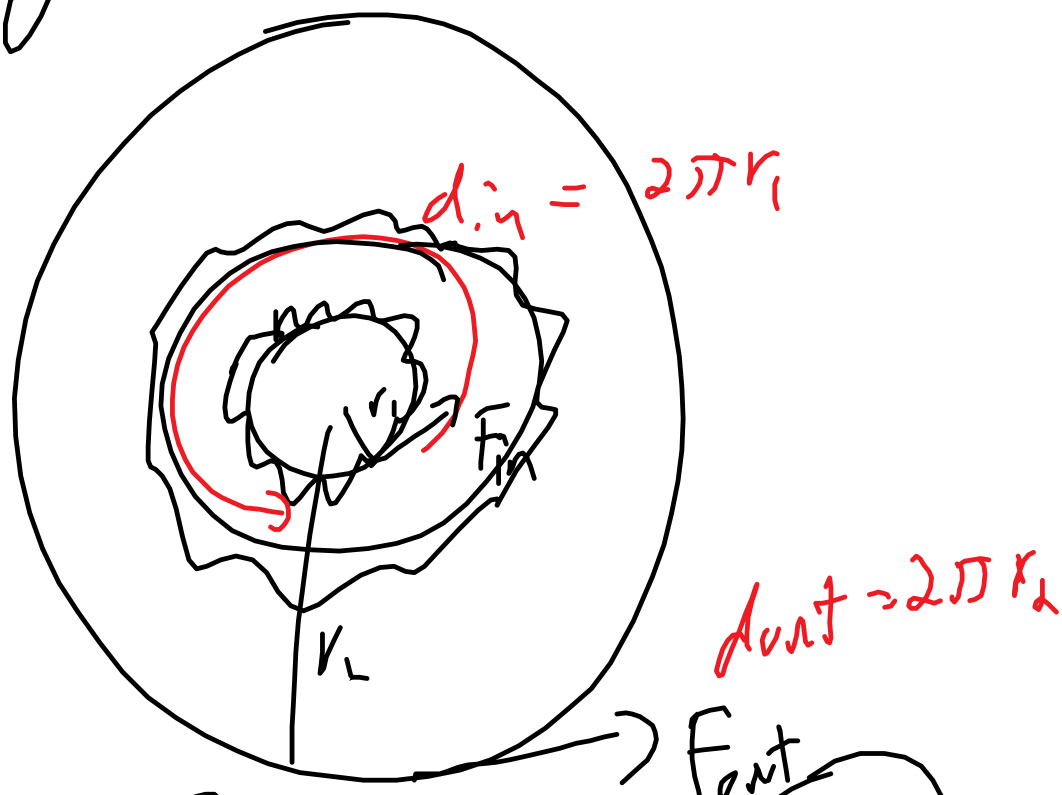
Q16

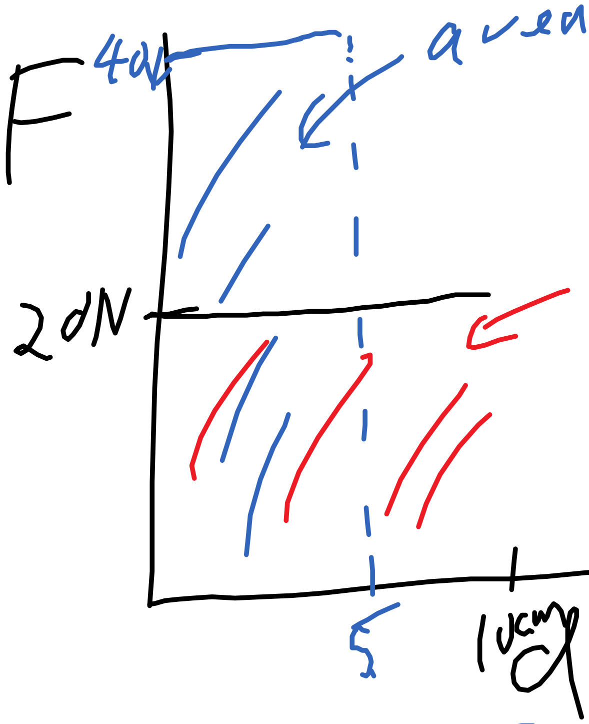


$$MA = \frac{F_{out}}{F_{in}} = IMA = \frac{d_{in}}{d_{out}}$$

IMA, MA, F_{out} double

for same F_{in}, d_{out}

2.3



area $= 40N \times 0.05m$
$= \boxed{2.0J}$

area $= W$
$= Fd$
$= 20N \times 0.10m$
$= \boxed{2.0\ J}$

$$MA = \frac{F_{out}}{F_{in}} = \frac{d_{in}}{d_{out}}$$

$$2.0 = \frac{F_{out}}{20N}$$

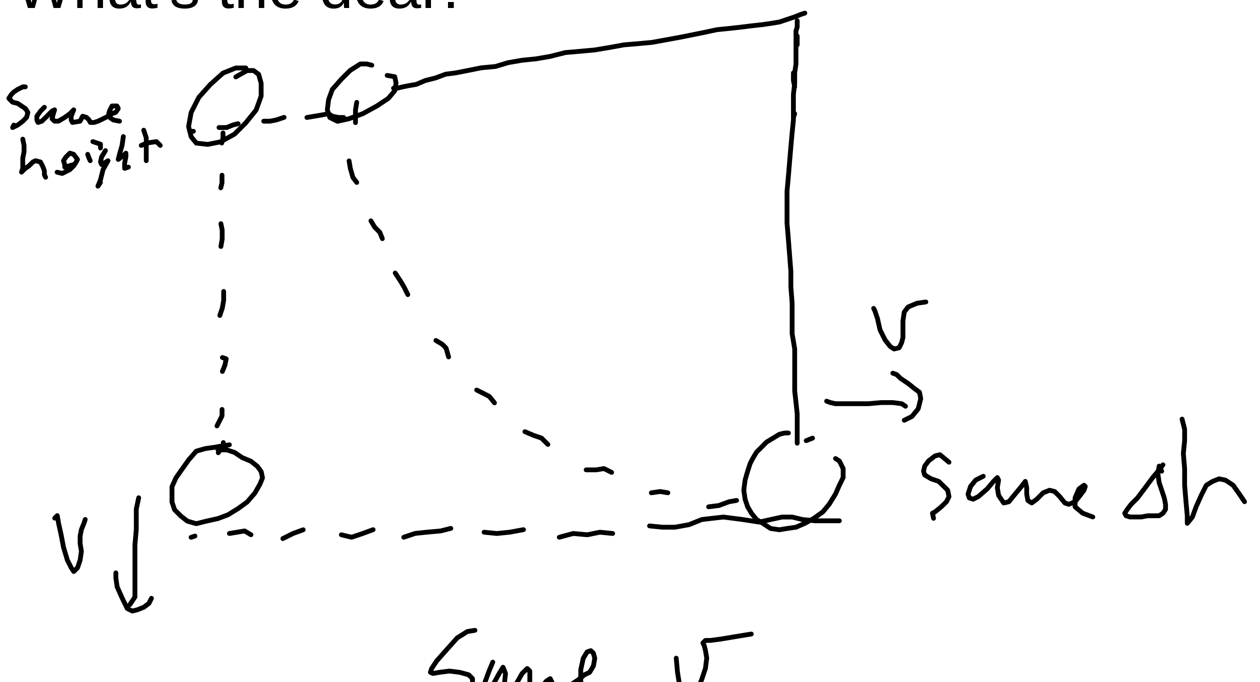
$$F_{out} = 40N$$

Energy (chapter 11)

Demos:
Balloon of Death
Bowling Ball of Death
Drop vs Swing
A ball is dropped and the speed is measured at the bottom of the drop.
Another identical ball is swung from the same height.
How does the speed of the swung ball relate to the speed of the falling ball?
Prediction: a) faster b) slower c) same d) depends
Reasoning:

Result: The two balls were moving at the same speed regardless of the path - straight down or swing.

What's the deal?



Reason: both balls start with the same initial gravitational potential energy and kinetic energy(energy of motion).
If energy is conserved for both, the lost gravitational energy is transformed into kinetic energy independent of the path.

Derive expressions for gravitational potential energy, E_g, and kinetic energy, E_k from

Work = change in energy = Fd

E_g

$W_g = \Delta E_g = F_g d = F_g \Delta h = mg\Delta h$

$E_g = mgh$ *

Kinetic Energy, E_k

Energy of motion.

Work done by the net force = change in kinetic energy

$W_{net}=\Delta E_k = F_{net}d = mad$

Recall from kinematics: a,d,v_f, v_i

$V_f^2=v_i^2 + 2ad$

$ad= 1/2 (V_f^2-v_i^2)$

$\Delta E_k = m\, 1/2 (V_f^2-v_i^2) = 1/2\, mv_f^2 - 1/2mv_i^2$

Ekf Eki

$E_k = 1/2\ mv^2$

Eg. A 0.10 kg mass is dropped from a height of 0.70m. Determine:

a) Initial gravitational energy of the mass
b) The speed of the mass if it falls straight down
c) The speed of the mass if it falls through an arc of 1.2m of distance to the same bottom point.
d) If the speed at the bottom is only 2.0m/s, how much energy is lost? Where did it go?

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